ETHNOBOTANICAL AND ETHNOPHARMACOLOGICAL DOCUMENTATION OF ANTIMALARIAL PLANTS USED BY THE JAKUN COMMUNITY IN KG PETA, ENDAU-ROMPIN, JOHOR, MALAYSIA

IZDIHAR BINTI ISMAIL

A thesis submitted in
fulfillment of the requirement for the award of the degree of
Master of Science

Faculty of Science, Technology and Human Development
Universiti Tun Hussein Onn Malaysia

APRIL 2017

This thesis is dedicated to my beloved mother, Rohanah Hashim
a strong and gentle soul
who is nursing me with affection and love
and her dedication to my success in life
&
to my husband, Faiz Akmal
for earning an honest living for us and
for supporting and encouraging me to believe in myself.

In memory of
my late father, Ismail Alip
without you
I would not be who I am today.

ACKNOWLEDGEMENT

Most of all, I would like to offer my heartfelt gratitude to Almighty God for giving me this great privilege and wisdom to carry out and complete this work.

I take pride acknowledging my main supervisor Assoc. Prof. Dr. Alona Cuevas Linatoc and co-supervisor Prof. Emeritus Datin Dr. Maryati Mohamed, Department of Technology and Heritage, University Tun Hussein Onn Malaysia for their unfailing optimism, dedication, encouragement, help and support that they gave me to carry out this work successfully.

I am thankful to Department of Orang Asli Development (JAKOA) for the approval to conduct the research. My special thanks to residents of Kg. Peta, Endau-Rompin, Johor especially, Kak Ayu, Wak Salam, Mak Weh, Mak Misah, Mak Meh for their kindness and help all throughout the duration of my field work. My appreciation also goes to those who are helping me directly and indirectly, my research group from Centre of Research for Sustainable Uses of Natural Resources (CoR-SUNR), and the Johor National Parks Corporation (JNPC) staffs and residents in Kg. Peta.

I am very grateful to Johor Biotechnology & Biodiversity Corporation (J-Biotech) for their cooperation in allowing me to use their facilities to carry out my laboratory work.

My sincere thanks also to plant taxonomist, Mr. Kamarudin Saleh from Flora Biodiversity Programme (FLORA), Division of Forest Biodiversity, Forest Research Institute Malaysia (FRIM) for the time spent in taxonomical identification of my plant samples.

This research has been supported by the UTHM Multidisciplinary Research (MDR) Grant Vot 1314, without which this study would have not been possible.

Finally, I would like to thank to my family and my husband, Faiz Akmal for their patience, understanding, support and belief in my ability to complete this study.

ABSTRACT

Malaria, one of the leading infectious diseases in many tropical regions including Malaysia is caused by the parasite *Plasmodium*. An ethnobotanical survey of medicinal plants used by the indigenous people particularly the Jakun tribe from Kg. Peta, Endau-Rompin, Johor for the treatment of malaria and malaria associated symptoms was conducted using a semi-structured interview. The declining popularity of application of traditional remedies by the young generation threatens the disappearance of traditional knowledge possessed mainly by the older generation. Hence, the need for documentation of this knowledge justifies the relevance of this study. Out of 19 species (17 families) were recorded, 7 species: *Hodgsonia macrocarpa*, *Pentaphragma begoniifolium*, *Rennellia elliptica*, *Saprosma corymbosa*, *Strychnos ignatii*, *Tacca integrifolia* and *Tetracera macrophylla* were investigated for phytochemical and *in vitro* antiplasmodial activities. Twelve aqueous and 12 methanolic extracts were screened for antiplasmodial phytochemical classes i.e., alkaloids, flavonoids, terpenoids and anthraquinones using thin-layer chromatography (TLC). Results revealed the presence of at least one of the phytochemical class in each extracts. Extracts were subjected to antiplasmodial activity through histidine-rich protein II (HRP2) assay against K1 strain of *P. falciparum* chloroquine-resistant. Overall, ten methanolic extracts from *H. macrocarpa* (stem), *P. begoniifolium* (root, stem and leaves), *R. elliptica* (root, stem and leaves), *S. corymbosa* (leaves), *T. integrifolia* (root) and *T. macrophylla* (stem) have potential antiplasmodial activities against chloroquine-resistant *P. falciparum* (IC_{50} < 10 µg/mL). The part of the plants species involves indicates statistically significant difference of IC_{50} between the kinds of extractions ($p < 0.05$). The results scientifically validated the plants used in Jakun's traditional medicine displayed promising therapeutic properties and further studies could lead to develop phytomedicines in the treatment of malaria.

ABSTRAK

Malaria, salah satu penyakit berjangkit yang utama di kebanyakan kawasan tropika termasuk Malaysia yang disebabkan oleh parasit *Plasmodium*. Satu survei etnobotani tumbuhan ubat-ubatan yang digunakan oleh orang-orang asli terutamanya suku Jakun yang tinggal di Kg. Peta, Endau-Rompin, Johor bagi rawatan malaria dan gejala-gejalanya telah dijalankan menggunakan temu duga separa terarah. Penurunan populariti penggunaan ubat-ubatan tradisional oleh generasi muda menyebabkan kepupusan pengetahuan tradisional terutamanya yang dimiliki oleh generasi tua. Oleh itu, keperluan mendokumentasi pengetahuan ini adalah bagi menjustifikasi kerelevanan kajian ini. Daripada 19 spesies (17 famili) yang direkodkan, 7 spesies: *Hodgsonia macrocarpa*, *Pentaphragma begoniifolium*, *Rennellia elliptica*, *Saprosma corymbosa*, *Strychnos ignatii*, *Tacca integrifolia* dan *Tetracera macrophylla* telah dikaji bagi fitokimia dan aktiviti *in vitro* antiplasmodial. Dua belas akueus dan 12 ekstrak metanol telah disaring bagi kelas fitokimia antiplasmodial i.e., alkaloid, flavonoid, terpenoid dan antrakuinon dengan menggunakan kromatografi lapisan-nipis (TLC). Hasil kajian menunjukkan kehadiran sekurang-kurangnya satu kelas fitokimia dalam setiap ekstrak. Ekstrak-ekstrak ini menjalani aktiviti antiplasmodial melalui assai protein kaya-histidina II (HRP2) terhadap strain K1 *P. falciparum* rintang-klorokuina. Keseluruhannya, sepuluh ekstrak metanol iaitu *H. macrocarpa* (batang), *P. begoniifolium* (akar, batang dan daun), *R. elliptica* (akar, batang dan daun), *S. corymbosa* (daun), *T. integrifolia* (akar) dan *T. macrophylla* (batang) mempunyai potensi aktiviti antiplasmodial terhadap *P. falciparum* rintang-klorokuina (IC_{50} < 10 μg/mL). Bahagian spesies tumbuhan yang terlibat menunjukkan perbezaan statistik IC_{50} yang signifikan antara jenis pengekstrakan ($p < 0.05$). Hasil kajian telah mengesahkan secara saintifik bahawa tumbuhan yang digunakan dalam perubatan tradisional masyarakat Jakun ini memaparkan ciri terapeutik dan kajian lanjutan mampu membawa kepada pembangunan fitokimia dalam rawatan malaria.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

~	-	Similarity
>	-	Greater than
<	-	Less than
±	-	Uncertainty
%	-	Percentage
°C	-	Degree Celsius
µg/mL	-	Microgram per milliliter
µL	-	Microliter
µL/well	-	Microliter per well
µM	-	Micromolar
cm	-	Centimeter
g	-	Gram
g/mL	-	Gram per milliliter
gsm	-	Grams per square meter
ha	-	Hectare
in	-	Inch
kg	-	Kilogram
km	-	Kilometer
km^2	-	Square kilometer
m	-	Meter
mg	-	Milligram
mg/kg	-	Milligram per kilogram
mg/mL	-	Milligram per milliliter
mM	-	Millimolar
mm	-	Millimeter
mL	-	Milliliter
ng/mL	-	Nanogram per milliliter

nM	-	Nanomolar
nm	-	Nanometer
rpm	-	Revolutions per minute
w/w	-	Weight per weight
wt/vol	-	Weight per volume
ABS	-	Access and Benefit Sharing
ACT	-	Artemisinin based Combination Therapy
ANOVA	-	Analysis of Variance
Art	-	Artemisinin
ASMQ	-	Artesunate-mefloquine
B.C.	-	Before Christ
BSA	-	Bovine serum albumin
BSCII	-	Biosafety Cabinet Class II
C_6H_{14}	-	Hexane
$C_4H_8O_2$	-	Ethyl acetate
$C_4H_{10}O$	-	Butanol
CBD	-	Convention on Biological Diversity
CCM	-	Complete Culture Medium
CH_3COOH	-	Acetic acid
CO_2	-	Carbon dioxide
CQ	-	Chloroquine
DBP	-	Dewan Bahasa dan Pustaka
DCM	-	Dichloromethane
DMSO	-	Dimethyl suplhoxide
E	-	East
ELISA	-	Enzyme-linked Immunosorbent Assay
EtOAc	-	Ethyl acetate
FAO	-	Food and Agriculture Organization
FRIM	-	Forest Research Institute Malaysia
GMT	-	Greenwich Mean Time
GPS	-	Global Positioning System
H_2O	-	Water
H_2SO_4	-	Sulfuric acid
HEPES	-	4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid

HRP2	-	Histidine-rich Protein II
IC_{50}	-	50% Inhibitory Concentration
IC_{90}	-	90% Inhibitory Concentration
IgG	-	Immunoglobulin G
IgM	-	Immunoglobulin M
ILO	-	International Labour Organization
IMR	-	Institute for Medical Research
JAKOA	-	Department of Orang Asli Development
JNPC	-	Johor National Parks Corporation
Kg.	-	Kampung
M	-	Molar
Mef	-	Mefloquine
MeOH	-	Methanol
MOH	-	Ministry of Health Malaysia
N	-	North
NaCl	-	Sodium chloride
$NaHCO_3$	-	Sodium bicarbonate
NATO	-	North Atlantic Treaty Organization
OD	-	Optical Density
PBS	-	Phosphate buffer solution
PBST	-	PBS-Tween
pH	-	Power of Hydrogen
PIC	-	Prior Inform Consent
pLDH	-	Plasmodium Lactate Dehydrogenase
Q	-	Quinine
R&D	-	Research and Development
RAMSAR	-	The Convention on Wetlands of International Importance
RBC	-	Red blood cell
R_f	-	Relative Front
RPMI	-	Roswell Park Memorial Institute Medium
SDX/PYR	-	Sulfadoxine/pyrimethamine
SPR	-	Slide Positivity Rate
THM	-	Traditional Herbal Medicine

TK	-	Traditional Knowledge
TLC	-	Thin-layer Chromatography
TM	-	Traditional Medicine
TMB	-	3,3', 5,5;-tetramethylbenzidine
TNJER	-	Johor National Park Endau-Rompin
UNCCD	-	United Nations Convention to Combat Desertification
UNCED	-	United Nations Conference on the Environment and Development
UNEP	-	United Nations Environment Programme
UNESCO	-	United Nations Educational Scientific and Cultural Organization
USA	-	United States of America
UTHM	-	Universiti Tun Hussein Onn Malaysia
UV	-	Ultraviolet
WHO	-	World Health Organization
WIPO	-	World Intellectual Property Organization

LIST OF APPENDICES

LIST OF PUBLICATIONS

Journals:

(i) **Ismail, I.,** Linatoc, A. C., Mohamed, M., & Tokiman, L. (2015). Documentation of medicinal plants traditionally used by the Jakun people of Endau-Rompin (Peta) for treatments of malaria-like symptoms. *Jurnal Teknologi, 77(31),* 63-69.

(ii) **Ismail, I.,** Linatoc, A. C., & Mohamed, M. (2016). Antiplasmodial potential of selected medicinal plants used traditionally in Johor National Park Endau-Rompin. *International Journal of Pharmacy and Pharmaceutical Sciences*.
[Accepted with minor correction]

Proceeding/ Conference/ Seminar:

(i) **Ismail, I.,** Linatoc, A. C., Mohamed, M., & Tokiman, L. (2014). Documentation of medicinal plans traditionally used in treatments of malaria. In *Bio Johor 2014*, Persada Johor Convention Centre, Johor Bahru, 25-27 August 2014.

(ii) **Ismail, I.,** Linatoc, A. C., Mohamed, M., & Tokiman, L. (2015). Traditional knowledge on medicinal plants among the Jakun people for the treatment of malaria-like symptoms in Kampung Peta, Endau-Rompin Johor, Malaysia. In *International Conference on Biodiversity (ICB) 2015*, Universiti Tun Hussein Onn Malaysia, Johor, 16-17 November 2015.

(iii) **Ismail, I.,** Linatoc, A. C., Mohamed, M., & Tokiman, L. (2016). Herbal medicine traditionally used by indigenous people in Endau-Rompin, Johor, Malaysia. In *Joint Seminar on Biodiversity & Conservation UTHM-UGM*. Universitas Gadjah Mada, Yogyakarta, 13 April 2016.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Ethnobotanical research involves the relationship between human and plants in many aspects of life such as food resources, portion in cosmetics, base in textiles and elements in farming. Ethnopharmacology on the other hand, emphasizes on the pharmacological treatment in general (Ríos, 2011). Such study is itemized on the bio-evaluation of the effectiveness of traditional medicines. Ethnomedicine also has close relation with ethnobotany and ethnopharmacology as it is based on written sources and verbal information such as knowledge and practices which are passed from generations to generations for centuries (Ríos, 2011).

In the modern era, some people are still practicing traditional treatment and medication in their lives. Most of the under-developed countries practically uses the plants and herbs for health and treatment which are the repetition of their ancestors' practices for generations. In Malaysia, majority of natives from different ethnics exercise different traditions in using herbs and plants as medicinal sources. They have a close relationship with the forest since forest products have traditionally formed as the basis of their livelihood (Lin, 2005).

Medicinal plants are used by Orang Asli Jakun in Kg. Peta, Endau-Rompin to treat and cure people who were infected by certain illnesses or diseases. The location where they stay in the Johor National Park Endau-Rompin (TNJER) make it possible for them to access suitable plants and herbs in the treatment of various illnesses or used as sources of food. Most of the older generation (above 40 years old) who believed in the traditional medication based on plants. Therefore, they are

knowledgeable in many aspects of traditional medication and practices. This traditional knowledge (TK) and practices are inherited and passed on continuously to the younger generation. This traditional knowledge is essential to be preserved but the young generations now lack the urge to learn the traditional practices as they prefer the convenience provided by the use of modern medication. The consequence of the new generation being indulged in modernizations results in the erosion of traditional knowledge (Ismail *et al*., 2014). Hence, the ways in which the Orang Asli Jakun in Kg. Peta treats illnesses like malaria and malaria-associated symptoms should be documented promptly so that the TK on the use of medicinal plants may be preserved before they are eroded and totally forgotten.

Like any other communities, the Orang Asli of TNJER also suffer from malaria. Malaria is a very old disease and a major public health concern in many tropical and subtropical countries (Jonville *et al*., 2008; Adebayo & Krettli, 2011; Basir *et al*., 2012) including Malaysia even though malaria control and prevention activities over the last few decades have greatly reduced the incidence of malaria (Sanders *et al*., 2014).

Malaria is an infectious disease transmitted from one person to another via the bite of female *Anopheles* mosquito. There are four species of plasmodia causing malaria in humans, namely: *Plasmodium falciparum, P. vivax, P. malariae* and *P. ovale* (Adebayo & Krettli, 2011; WHO, 2014). Additionally, *P. knowlesi*, a simian malaria parasite is now recognized as the fifth plasmodium species that can cause malaria to humans (Singh & Daneshvar, 2010; Azidah *et al*., 2014).

The onsets of malaria symptoms are nonspecific. This is due to presence of one or more vague features of general body weakness. The incubation period is about 10 to 15 days after the first bite by the infected mosquito. The symptoms appear are fever, chills, shivering, headache, loss of appetite, vomiting, dizziness, muscle and joint aches, fatigue and nausea. If severe cases of malaria are not addressed properly, this can lead to complications and eventually death (WHO, 2014).

1.2 Problem statements

1.2.1 The erosion of traditional knowledge (TK)

All community of indigenous people worldwide possess their own unique traditional knowledge. Traditional knowledge is very diverse. It covers literary, artistic or scientific works, song, dance, medical treatments and practices as well as agricultural technologies and techniques. The precious medicinal values that hold by folk medicines usually belong to indigenous people as they have been using medicinal plants since myriad of time (Lim *et al*., 2010).

Medicinal plants have been demonstrated to be potential source in the medical field while the indigenous people keep and transfer the knowledge and practices usually through an informal system and adapting it as their way of life. This knowledge is often transmitted from one generation to another as such the traditional uses of many plants have not been documented. The lack of survey and documentation of medicinal plants that are used by indigenous people leads to knowledge erosion and lost with succeeding generations.

This phenomenon occurs in Malaysia due to less consciousness among the community of the indigenous ethnics about traditional knowledge (Kulip, 2003; Lin, 2005; Samuel *et al*., 2010). The documentation of traditional usage of medicinal plants to treat certain diseases is still less favorable. In contrast with others ethnics in the world such as the Chinese, the Indians, the Bhutanese and etc., keep upgrading the data into pharmacopoeia. In addition, nowadays the young generations just take a shortcut by receiving modern treatment in hospital. They are use conventional approach because of the belief to modern medicine is strongly convincing. Exposure to modern culture also a key reasons that contribute to degradation of traditional knowledge.

Hence, by conducting a proper survey and documentation be able to avoid danger of losing this precious knowledge before degradation of natural habitats and ecosystems leading to loss of plants and cultural diversity. Therefore, there is a need to document traditional knowledge especially about medicinal plant diversity and how the native communities are using them.

REFERENCES

A.Vogel. (2016). *Strychnos ignatii* Berg. Retrieved February 8, 2016, from https://www.avogel.com/plant-encyclopaedia/strychnos_ignatii.php

Abd Rahman, S. (2012). The Jakun indigenous tribe of Bebar, Pahang, Malaysia. *Interdisciplinary Journal of Research in Business, 2(6),* 25-32.

Abd Razak, M. F., Aidoo, K. E., & Candlish, A. G. (2007). Mutagenic and cytotoxic properties of three herbal plants from Southeast Asia. *Tropical Biomedicine, 24(2),* 49-59.

Abdul Latiff, S. (2010). Potensi keusahawanan di kalangan Orang Asli. *Prosiding Persidangan Kebangsaan Ekonomi Malaysia ke V*. Bangi: Universiti Kebangsaan Malaysia. 80-87.

Abdullah, W. O., Unyah, N. Z., Hamat, R. A., Omar, B., Abd Ghani, M. K., Rayani, M., & Hatam, G. R. (2011). *In vitro* antiplasmodial activity and cytotoxicity of ten plants used as traditional medicine in Malaysia. *Jurnal Sains Kesihatan Malaysia, 9(2),* 5-8.

Achan, J., Talisuna, A. O., Erhart, A., Yeka, A., Tibenderana, J. K., Baliraine, F. N., Rosenthal, P. J., & D'Alessandro, U. (2011). Quinine, an old anti-malarial drug in a modern world: Role in the treatment of malaria. *Malaria Journal, 10(144),* 1-12.

Adebayo, J. O., & Krettli, A. U. (2011). Potential antimalarials from Nigerian plants: A review. *Journal of Ethnopharmacology, 133(2),* 289-302.

Ahmad, F.B., & Ismail, G. (2003). Medicinal plants used by Kadazandusun communities around Crocker Range. *Proceedings of the ASEAN Review of Biodiversity and Environmental Conservation (ARBEC)*. 1-10.

Al-Adhroey, A. H., Nor, Z. M., Al-Mekhlafi, H. M., & Mahmud, R. (2010). Ethnobotanical study on some Malaysian anti-malarial plants: A community based survey. *Journal of Ethnopharmacology, 132(1),* 362-364.

Albertus, Dewantara, I., & Herawatiningsih, R. (2015). Jenis dan potensi tumbuhan obat pada kawasan Hutan Adat Gunung Semarong Kecamatan Tayan Hulu Kabupaten Sanggau. *Jurnal Hutan Lestari, 3(3),* 446-455.

Alias, H., Surin, J., Mahmud, R., Shafie, A., Mohd Zin, J., Mohamad Nor, M., Ibrahim, A. S., & Rundi, C. (2014). Spatial distribution of malaria in Peninsular Malaysia from 2000 to 2009. *Parasites & Vectors, 7,* 1-7.

Armitage, C. J., & Conner, M. (1999). Predictive validity of the theory of planned behaviour: The role of questionnaire format and social desirability. *Journal of Community & Applied Social Psychology, 9(4),* 261-272.

Asase, A., Akwetey, G. A., & Achel, D. G. (2010). Ethnopharmacological use of herbal remedies for the treatment of malaria in the Dangme West District of Ghana. *Journal of Ethnopharmacology, 129(3),* 367-376.

Asase, A., Oteng-Yeboah, A. A., Odamtten, G. T., & Simmonds, M. S. J. (2005). Ethnobotanical study of some Ghanaian anti-malarial plants. *Journal of Ethnopharmacology, 99(2),* 273-279.

Ashley, E., McGready, R., Proux, S., & Nosten, F. (2006). Malaria. *Travel Medicine and Infectious Disease, 4(3–4),* 159-173.

Asiah, O., Nurhanan, M. Y., & Ilham, M. A. (2007). Determination of bioactive peptide (4.3 kDa) as an aphrodisiac marker in six Malaysian plants. *Journal of Tropical Forest Science, 19(1),* 61-63.

Asmah, O. (1983). *The Malay People of Malaysia and Their Languages*. Kuala Lumpur: Dewan Bahasa Dan Pustaka.

Autsavakitipong, T., Khonsung, P., Panthong, A., Chiranthanut, N., Kunanusorn, P., Nuntasaen, N., Jaipetch, T., Bunteang, S., & Reutrakul, V. (2015). Preliminary evaluation of the analgesic and anti-inflammatory effects of *Tacca integrifolia* in rodents. *International Journal of Applied Research in Natural Products, 8(1),* 20-25.

Azidah, A. K., Mohd Faizal, M. A., Lili, H. Y., & Zeehaida, M. (2014). Severe *Plasmodium knowlesi* infection with multiorgan involvement in north east peninsular Malaysia. *Tropical Biomedicine, 31(1),* 31-35.

Azliza, M. A., Ong, H. C., Vikineswary, S., Noorlidah, A., & Haron, N. W. (2012). Ethno-medicinal resources used by the Temuan in Ulu Kuang Village. *Ethno Medicine, 6(1),* 17-22.

Barreiro, E. J., Fraga, C. A. M., & Lima, L. M. (2012). Natural products as lead compounds in medicinal chemistry. in Cechinel-Filho, V. (Ed.). *Plant Bioactives and Drug Discovery: Principles, Practice, and Perspectives*. 81-126.

Baruah, S., Borthakur, S. K., Gogoi, P., & Ahmed, M. (2013). Ethnomedicinal plants used by *Adi-Minyong* tribe of Arunachal Pradesh, Eastern Himalaya. *Indian Journal of Natural Products and Resources, 4(3),* 278-282.

Barukial, J., & Sarmah, J. N. (2011). Ethnomedicinal plants used by the people of Golaghat district, Assam, India. *International Journal of Medicinal and Aromatic Plants, 1(3),* 203-211.

Basir, R., Chan, K. L., Yam, M. F., Othman, F., Abdullah, W. O., Mohd Moklas, M. A., Rahim, A. S. A., Ismail, I. S., Hidayat, M. T., Taib, C. N. M., & Mahmud, R. (2012). Antimalarial activity of selected Malaysian medicinal plants. *Phytopharmacology, 3(1),* 82-92.

Batista, R., De Jesus Silva Júnior, A., & De Oliveira, A. B. (2009). Plant-derived antimalarial agents: New leads and efficient phytomedicines. Part II. Non-alkaloidal natural products. *Molecules, 14(8),* 3037-3072.

Beniddir, M., Litaudon, M., Rasoanaivo, P., Grellier, P., & Guéritte, F. (2011). From structural studies of natural products to the discovery of a selective antiplasmodial derivative: A serendipity story. *Planta Medica, 77(12),* PL31.

Bourdy, G., Oporto, P., Gimenez, A., & Deharo, E. (2004). A search for natural bioactive compounds in Bolivia through a multidisciplinary approach: Part VI. Evaluation of the antimalarial activity of plants used by Isoceño-Guaraní Indians. *Journal of Ethnopharmacology, 93(2),* 269-277.

Bourgaud, F., Gravot, A., Milesi, S., & Gontier, E. (2001). Production of plant secondary metabolites: A historical perspective. *Plant Science, 161(5),* 839-851.

Brahmachari, G. (2009). Mother nature - An inexhaustible source of drugs and lead molecules. in Brahmachari, G. (Ed.). *Natural Products: Chemistry, Biochemistry and Pharmacology*. United Kingdom: Alpha Science International Limited. 1-20.

Bremer, B., & Eriksson, T. (2009). Time tree of Rubiaceae: Phylogeny and dating the family, subfamilies, and tribes. *International Journal of Plant Sciences, 170(6),* 766-793.

Bruce, N. C. (2008). Alkaloids. in Rehm, H. J., & Reed, G. (Eds.). *Biotechnology Set, Second Edition*. Weinheim: Wiley. 327-361.

Burkill, I. H. (1966). *A Dictionary of Economic Products of the Malay Peninsula*. 2nd ed. Kuala Lumpur: Ministry of Agriculture and Cooperative of Malaysia.

Butler, R., A. (2013). Malaysia has the world's highest deforestation rate, reveals Google forest map. *Mongabay*

Cartea, M. E., Francisco, M., Soengas, P., & Velasco, P. (2011). Phenolic compounds in *Brassica* vegetables. *Molecules, 16(1),* 251-280.

Christensen, H. (2002). *Ethnobotany of the Iban and the Kelabit*. Sarawak: Forest Department Sarawak.

Chuakul, W., Soonthornchareonnon, N., Boonjaras, T., & Boonpleng, A. (2004). Survey on medicinal plants in Southern Thailand. *Thai Journal of Phytopharmacy, 11(2),* 29-52.

Chukwujekwu, J. C., Smith, P., Coombes, P. H., Mulholland, D. A., & Van Staden, J. (2005). Antiplasmodial diterpenoid from the leaves of *Hyptis* suaveolens. *Journal of Ethnopharmacology, 102(2),* 295-297.

Convention on Biological Diversity (CBD). (2015). Introduction. Retrieved December 17, 2015, from https://www.cbd.int/traditional/intro.shtml

Cowan, M. M. (1999). Plant products as antimicrobial agents. *Clinical Microbiology Reviews, 12(4),* 564-582.

Croteau, R., Kutchan, T. M., & Lewis, N. G. (2015). Natural products (Secondary metabolites). in Buchanan, B. B., Gruissem, W., & Jones, R. L. (Eds). *Biochemistry and Molecular Biology of Plants*. United Kingdom: Wiley Blackwell. 1250-1319.

Dai, J., & Mumper, R. J. (2010). Plant phenolics: Extraction, analysis and their antioxidant and anticancer properties. *Molecules, 15(10),* 7313-7352.

Das, K., Tiwari, R. K. S., & Shrivastava, D. K. (2010). Techniques for evaluation of medicinal plant products as antimicrobial agents: Current methods and future trends. *Journal of Medicinal Plants Research, 4(2),* 104-111.

De Wilde, W. J. J. O., & Duyfjes, B. E. E. (2001). Taxonomy of *Hodgsonia* (Cucurbitaceae), with a note on the ovules and seeds. *Blumea, 46(1),* 169-179.

Dewan Bahasa dan Pustaka. (2013). *Kamus Dewan.* 4th ed. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Dike, I. P., Obembe, O. O., & Adebiyi, F. E. (2012). Ethnobotanical survey for potential anti-malarial plants in south-western Nigeria. *Journal of Ethnopharmacology, 144(3),* 618-626.

Dons, T., & Soosairaj, S. (2013). Treatment of jaundice by traditional healthcare system. *International Journal of Biology, Pharmacy and Allied Sciences, 2(6),* 1373-1378.

Elkhateeb, A., Subeki, Takahashi, K., Matsuura, H., Yamasaki, M., Yamato, O., Maede, Y., Katakura, K., Yoshihara, T., & Nabeta, K. (2005). Anti-babesial ellagic acid rhamnosides from the bark of *Elaeocarpus parvifolius*. *Phytochemistry, 66(21),* 2577-2580.

Endale, M., Ekberg, A., Alao, J. P., Akala, H. M., Ndakala, A., Sunnerhagen, P., Erdélyi, M., & Yenesew, A. (2013). Anthraquinones of the roots of *Pentas micrantha*. *Molecules, 18(1),* 311-321.

Eswani, N., Kudus, K. A., Nazre, M., & Noor, A. G. A. (2010). Medicinal plant diversity and vegetation analysis of logged over hill forest of Tekai Tembeling Forest Reserve, Jerantut, Pahang. *Journal of Agricultural Science, 2(3),* 189-210.

Evans, W. C. (2009). *Trease and Evans Pharmacognosy*. 16th ed. Amsterdam: Elsevier.

Fabricant, D. S., & Farnsworth, N. R. (2001). The value of plants used in traditional medicine for drug discovery. *Environmental Health Perspectives, 109(Suppl 1),* 69-75.

Fotie, J. (2009). Natural products and protozoan neglected diseases: Malaria, trypanosomiasis and leishmaniasis. in Brahmachari, G. (Ed.). *Natural Products: Chemistry, Biochemistry and Pharmacology*. United Kingdom: Alpha Science International Limited. 137-193.

Frédérich, M., Choi, Y. H., Angenot, L., Harnischfeger, G., Lefeber, A. W., & Verpoorte, R. (2004). Metabolomic analysis of *Strychnos nux-vomica*, *Strychnos icaja* and *Strychnos ignatii* extracts by ^{1}H nuclear magnetic resonance spectrometry and multivariate analysis techniques. *Phytochemistry, 65(13),* 1993-2001.

Frederich, M., Hayette, M. P., Tits, M., De Mol, P., & Angenot, L. (1999). In vitro activities of *Strychnos* alkaloids and extracts against *Plasmodium falciparum*. *Antimicrobial Agents and Chemotherapy, 43(9),* 2328-2331.

Frédérich, M., Jacquier, M. J., Thépenier, P., De Mol, P., Tits, M., Philippe, G., Delaude, C., Angenot, L., & Zèches-Hanrot, M. (2002). Antiplasmodial activity of alkaloids from various *Strychnos* species. *Journal of Natural Products, 65(10),* 1381-1386.

Gehling, M., Köpcke, B., Küper, T., Reinhardt, K., Reinemer, P., George, A., Chinnappan, S., & Akir, M. H. M. (2015). *Extract Formulations of Rhodamnia cineria and Uses Thereof*. U.S. Patent 14/382, 237.

Giday, M., Asfaw, Z., Elmqvist, T., & Woldu, Z. (2003). An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. *Journal of Ethnopharmacology, 85(1),* 43-52.

Gimlette, J. D., & Thomson, H. W. (1939). *A Dictionary of Malayan Medicine*. New York: Oxford University Press.

Gokani, T. (2014). Ayurveda - The science of healing. *Headache: The Journal of Head and Face Pain, 54(6),* 1103-1106.

Goun, E., Cunningham, G., Chu, D., Nguyen, C., & Miles, D. (2003). Antibacterial and antifungal activity of Indonesian ethnomedical plants. *Fitoterapia, 74(6),* 592-596.

Greenwood, B. M., Bojang, K., Whitty, C. J. M., & Targett, G. A. T. (2005). Malaria. *The Lancet, 365(9469),* 1487-1498.

Greenwood, B. M., Fidock, D. A., Kyle, D. E., Kappe, S. H. I., Alonso, P. L., Collins, F. H., & Duffy, P. E. (2008). Malaria: Progress, perils, and prospects for eradication. *The Journal of Clinical Investigation, 118(4),* 1266-1276.

Grosvenor, P. W., Gothard, P. K., McWilliam, N. C., Supriono, A., & Gray, D. O. (1995). Medicinal plants from Riau Province, Sumatra, Indonesia. Part 1: Uses. *Journal of Ethnopharmacology, 45(2),* 75-95.

Harborne, J. B. (1998). *Phytochemical Methods: A guide to modern techniques of plant analysis*. 3rd ed. London: Chapman & Hall.

Heilmann, J., Shwe, H. H., Aye, M., Sein, M. M., Kreitmeier, P., & Reiser, O. (2006). New furostanol glycosides from the rhizomes of *Tacca integrifolia*. *Planta Medica, 72*(11), P_343.

Hildreth, J., Hrabeta-Robinson, E., Applequist, W., Betz, J., & Miller, J. (2007). Standard operating procedure for the collection and preparation of voucher plant specimens for use in the nutraceutical industry. *Analytical and bioanalytical chemistry, 389(1),* 13-17.

Hoogland, R. D. (1953). The genus *Tetracera* (Dilleniaceae) in the Eastern Old World. *Reinwardtia, 2(2),* 185-224.

Hout, S., Chea, A., Bun, S. S., Elias, R., Gasquet, M., Timon-David, P., Balansard, G., & Azas, N. (2006). Screening of selected indigenous plants of Cambodia for antiplasmodial activity. *Journal of Ethnopharmacology, 107(1),* 12-18.

Ibrahim, F. H., & Hamzah, N. (1999). The use of medicinal plant species by the Temuan tribe of Ayer Hitam Forest, Selangor, Peninsular Malaysia. *Pertanika Journal of Tropical Agricultural Science, 22(2),* 85-94.

Ibrahim, J. (2005). Five decades of medicinal plants research in Malaysia: Scientific interests and advances. *Proceedings of the Seminar on Medicinal and Aromatic Plants*. Kepong: Forest Research Institute Malaysia. 1-23.

Idowu, O. A., Soniran, O. T., Ajana, O., & Aworinde, D. O. (2010). Ethnobotanical survey of antimalarial plants used in Ogun State, Southwest Nigeria. *African Journal of Pharmacy and Pharmacology, 4(2),* 055-060.

Ismail, I., Linatoc, A. C., Mohamed, M., & Tokiman, L. (2015). Documentation of medicinal plants traditionally used by the Jakun people of Endau-Rompin (Peta) for treatments of malaria-like symptoms. *Jurnal Teknologi, 77(31),* 63-69.

Ismail, N. H. (2014). *Unveiling Secrets of Nature*. Selangor: UiTM Press.

Ismail, N. H., Alias, A., & Osman, C. P. (2012). *Alkaloids and Anthraquinones from Malaysian Flora*. Malaysia: INTECH Open Access Publisher.

Iyamah, P. C., & Idu, M. (2015). Ethnomedicinal survey of plants used in the treatment of malaria in Southern Nigeria. *Journal of Ethnopharmacology, 173*, 287-302.

Jabatan Kemajuan Orang Asli. (2013). Suku Kaum/Bangsa. Retrieved Disember 21, 2013, from http://www.jakoa.gov.my/orang-asli/info-orang-asli/suku-kaumbangsa/

Jabatan Kemajuan Orang Asli. (2014). Maklumat Demografi Orang Asli 2013.

Jamiran, M. N. S. (2015). *Sosioekonomi Orang Asli Jakun di Kampung Peta*. Universiti Tun Hussein Onn Malaysia: Master's Thesis.

Jamiran, M. N. S., Seow, T. W., & Mohamed, M. (2013). Orang Asli dan persekitarannya: Kajian kes di Kampung Peta. *Prosiding Persidangan Penyelidikan dan Inovasi Kali ke-2*. Pulau Pinang. 210-218.

Janneck, L., Koyfman, A., & Takayesu, J. K. (2011). Clinical review of malaria for the emergency physician. *African Journal of Emergency Medicine, 1(3),* 126-130.

Jiang, J., Yang, H., Wang, Y., & Chen, Y. (2014). Phytochemical and pharmacological studies of the genus *Tacca*: A review. *Tropical Journal of Pharmaceutical Research, 13(4),* 635-648.

Jonville, M. C., Kodja, H., Humeau, L., Fournel, J., De Mol, P., Cao, M., Angenot, L., & Frédérich, M. (2008). Screening of medicinal plants from Reunion Island for antimalarial and cytotoxic activity. *Journal of Ethnopharmacology, 120(3),* 382-386.

Kagyung, R., Gajurel, P. R., Rethy, P., & Singh, B. (2010). Ethnomedicinal plants used for gastro-intestinal diseases by *Adi* tribes of Dehang-Debang Biosphere Reserve in Arunachal Pradesh. *Indian Journal of Traditional Knowledge, 9(3),* 496-501.

Kamal, N., Clements, C., Gray, A. I., & Edrada-Ebel, R. (2016). Anti-infective activities of secondary metabolites from *Vitex pinnata*. *Journal of Applied Pharmaceutical Science, 6(1),* 102-106.

Kamaraj, C., Kaushik, N. K., Rahuman, A. A., Mohanakrishnan, D., Bagavan, A., Elango, G., Zahir, A. A., Santhoshkumar, T., Marimuthu, S., Jayaseelan, C., Kirthi, A. V., Rajakumar, G., Velayutham, K., & Sahal, D. (2012). Antimalarial activities of medicinal plants traditionally used in the villages of Dharmapuri regions of South India. *Journal of Ethnopharmacology, 141(3),* 796-802.

Kamarudin, K. H., & Ngah, I. (2007). *Pembangunan Mapan Orang Asli*. Skudai: Penerbit UTM Press.

Kanokmedhakul, S., Kanokmedhakul, K., Yodbuddee, D., & Phonkerd, N. (2003). New antimalarial bis-dehydroaporphine alkaloids from *Polyalthia debilis*. *Journal of Natural Products, 66(5),* 616-619.

Kantamreddi, V. S. S., Parida, S., Kommula, S. M., & Wright, C. W. (2009). Phytotherapy used in Orissa state, India for treating malaria. *Phytotherapy Research, 23(11),* 1638-1641.

Kaou, A. M., Mahiou-Leddet, V., Hutter, S., Aïnouddine, S., Hassani, S., Yahaya, I., Azas, N., & Ollivier, E. (2008). Antimalarial activity of crude extracts from nine African medicinal plants. *Journal of Ethnopharmacology, 116(1),* 74-83.

Kappers, I. F., Aharoni, A., Van Herpen, T. W. J. M., Luckerhoff, L. L. P., Dicke, M., & Bouwmeester, H. J. (2005). Genetic engineering of terpenoid metabolism attracts bodyguards to *Arabidopsis*. *Science, 309(5743),* 2070-2072.

Karunamoorthi, K., & Tsehaye, E. (2012). Ethnomedicinal knowledge, belief and self-reported practice of local inhabitants on traditional antimalarial plants and phytotherapy. *Journal of Ethnopharmacology, 141(1),* 143-150.

Kayani, S. A., Masood, A., Achakzai, A. K. K., & Anbreen, S. (2007). Distribution of secondary metabolites in plants of Quetta-Balochistan. *Pakistan Journal of Botany, 39(4),* 1173-1179.

Kichu, M., Malewska, T., Akter, K., Imchen, I., Harrington, D., Kohen, J., Vemulpad, S. R., & Jamie, J. F. (2015). An ethnobotanical study of medicinal plants of Chungtia village, Nagaland, India. *Journal of Ethnopharmacology, 166,* 5-17.

Kitjaroennirut, N., Jansakul, C., & Sawangchote, P. (2005). Cardiovascular effects of *Tacca integrifolia* Ker-Gawl. extract in rats. *Songklanakarin Journal of Science and Technology, 27(2),* 281-289.

Kui, H. C. (2007*). Studies on Andrographis paniculata (Burm. f.) Nees (HDM 15) A Medicinal Native Plant of Brunei Darussalam*. University of the Royal Melbourne Institute of Technology: Ph.D. Thesis.

Kulip, J. (2003). An ethnobotanical survey of medicinal and other useful plants of Muruts in Sabah, Malaysia. *Telopea, 10(1),* 81-98.

Kulip, J. (2009). Medicinal plants of Sabah, Malaysia: Potential for agroforestry. *JIRCAS Working Report, 60,* 47-48.

Kwon, H. S., Park, J. A., Kim, J. H., & You, J. C. (2012). Identification of anti-HIV and anti-reverse transcriptase activity from *Tetracera scandens*. *BMB Reports, 45(3),* 165-170.

Lalfakzuala, R., Lalramnghinglova, H., & Kayang, H. (2007). Ethnobotanical usages of plants in western Mizoram. *Indian Journal of Traditional Knowledge, 6(3),* 486-493.

Lee, S. S., Chang, Y. S., & Noraswati, M. N. R. (2009). Utilization of macrofungi by some indigenous communities for food and medicine in Peninsular Malaysia. *Forest Ecology and Management, 257(10),* 2062-2065.

Leonti, M. (2011). The future is written: Impact of scripts on the cognition, selection, knowledge and transmission of medicinal plant use and its implications for ethnobotany and ethnopharmacology. *Journal of Ethnopharmacology, 134(3),* 542-555.

Lim, E. K., & Bowles, D. (2012). Plant production systems for bioactive small molecules. *Current Opinion in Biotechnology, 23(2),* 271-277.

Lim, H. F., Norini, H., Norshakila, Y., & Intan Nurulhani, B. (2010). FRIM Reports: Forest Traditional Knowledge Research and Development in Peninsular Malaysia. Forest Research Institute Malaysia. No. 92.

Lin, K. W. (2005). Ethnobotanical study of medicinal plants used by the Jah Hut peoples in Malaysia. *Indian Journal of Medical Sciences, 59(4),* 156-161.

Ling, S. K., Komorita, A., Tanaka, T., Fujioka, T., Mihashi, K., & Kouno, I. (2002). Iridoids and anthraquinones from the Malaysian medicinal plant, *Saprosma scortechinii* (Rubiaceae). *Chemical and Pharmaceutical Bulletin, 50(8),* 1035-1040.

Lao, L., Xu, L., & Xu, S. (2012). Traditional chinese medicine. in Längler, A., Mansky, P. J., & Seifert, G. (Eds). *Integrative Pediatric Oncology*. New York: Springer Berlin Heidelberg. 125-135.

Lock, O., Castillo, P., Doroteo, V., & Rojas, R. (2005). Antioxidant activity in vitro of selected Peruvian medicinal plants. *Acta Horticulturae, 675,* 103-106.

Malaysian Biological Diversity Clearing House Mechanism (CHM). (2014). Flora Database. Retrieved May 22, 2014, from http://www.chm.frim.gov.my/

Maneenoon, K., Khuniad, C., Teanuan, Y., Saedan, N., Prom-in, S., Rukleng, N., Kongpool, W., Pinsook, P., & Wongwiwat, W. (2015). Ethnomedicinal plants used by traditional healers in Phatthalung Province, Peninsular Thailand. *Journal of Ethnobiology and Ethnomedicine, 11(1),* 1-20.

Maobe, M. A., & Nyarango, R. M. (2013). Fourier transformer infra-red spectrophotometer analysis of *Urtica dioica* medicinal herb used for the treatment of diabetes, malaria and pneumonia in Kisii region, Southwest Kenya. *World Applied Sciences Journal, 21(8),* 1128-1135.

Marais, J. P. J., Deavours, B., Dixon, R. A., & Ferreira, D. (2006). The stereochemistry of flavonoids. in Grotewold, E. (Ed.). *The Science of Flavonoids.* New York: Springer. 1-46.

Masron, T., Masami, F., & Ismail, N. (2013). Orang Asli in Peninsular Malaysia: Population, spatial distribution and socio-economic condition. *Journal of Ritsumeikan Social Sciences and Humanities, 6,* 75-115.

Mbatchi, S. F., Mbatchi, B., Banzouzi, J. T., Bansimba, T., Ntandou, G. F. N., Ouamba, J. -M., Berry, A., & Benoit-Vical, F. (2006). In vitro antiplasmodial activity of 18 plants used in Congo Brazzaville traditional medicine. *Journal of Ethnopharmacology, 104(1),* 168-174.

Medaglia, J. C., Phillips, F. K., & Perron-Welch, F. (Eds.) (2014). *Biodiversity Legislation Study*: *A Review of Biodiversity Legislation in 8 Countries*. Hamburg: World Future Council.

Meshram, A., & Srivastava, N. (2015). *Epipremnum Aureum* (Jade Pothos): A multipurpose plant with its medicinal and pharmacological properties. *Journal of Critical Reviews, 2(2),* 21-25.

Ministry of Health Malaysia. (2014*). Management of Malaria in Malaysia*. 1st ed. Kuala Lumpur: Ministry of Health Malaysia.

Mohagheghzadeh, A., Faridi, P., Shams-Ardakani, M., & Ghasemi, Y. (2006). Medicinal smokes. *Journal of Ethnopharmacology, 108(2),* 161-184.

Mohammad, N. S., Milow, P., & Ong, H. C. (2012). Traditional medicinal plants used by the Kensiu tribe of Lubuk Ulu Legong, Kedah, Malaysia. *Ethno Medicine, 6(3),* 149-153.

Moro, C. O., & Basile, G. (2000). Obesity and medicinal plants. *Fitoterapia, 71,(Suppl 1),* 73-82.

Moshi, M. J., Otieno, D. F., & Weisheit, A. (2012). Ethnomedicine of the Kagera Region, north western Tanzania. Part 3: Plants used in traditional medicine in Kikuku village, Muleba District. *Journal of Ethnobiology and Ethnomedicine, 8(1),* 1-11.

Muganga, R., Angenot, L., Tits, M., & Frédérich, M. (2010). Antiplasmodial and cytotoxic activities of Rwandan medicinal plants used in the treatment of malaria. *Journal of Ethnopharmacology, 128(1),* 52-57.

Murtem, G., & Chaudhry, P. (2016). An ethnobotanical study of medicinal plants used by the tribes in Upper Subansiri District of Arunachal Pradesh, India. *American Journal of Ethnomedicine, 3(3),* 2348-9502.

Musila, M. F., Dossaji, S. F., Nguta, J. M., Lukhoba, C. W., & Munyao, J. M. (2013). *In vivo* antimalarial activity, toxicity and phytochemical screening of selected antimalarial plants. *Journal of Ethnopharmacology, 146(2),* 557-561.

Nanda, G. C., Satapathy, K. B., & Pathak, N. N. (2002). Medicinal values of some *Vitex* species. *Proc. of the National Seminar on Plant Resources Utilization for Backward Area Development*. Bhubaneswar: Allied. 106-110.

National Health Service. (2015). Why must some medicines be taken on an empty stomach? Retrieved December 17, 2015, from http://www.nhs.uk/chq/pages/861.aspx?categoryid=73&subcategoryid=103

Nguyen-Pouplin, J., Tran, H., Tran, H., Phan, T. A., Dolecek, C., Farrar, J., Tran, T. H., Caron, P., Bodo, B., & Grellier, P. (2007). Antimalarial and cytotoxic activities of ethnopharmacologically selected medicinal plants from South Vietnam. *Journal of Ethnopharmacology, 109(3),* 417-427.

Noedl, H., Attlmayr, B., Wernsdorfer, W. H., Kollaritsch, H., & Miller, R. S. (2004). A histidine-rich protein 2–based malaria drug sensitivity assay for field use. *The American Journal of Tropical Medicine and Hygiene, 71(6),* 711-714.

Noedl, H., Bronnert, J., Yingyuen, K., Attlmayr, B., Kollaritsch, H., & Fukuda, M. (2005). Simple histidine-rich protein 2 double-site sandwich enzyme-linked immunosorbent assay for use in malaria drug sensitivity testing. *Antimicrobial Agents and Chemotherapy, 49(8),* 3575-3577.

Noedl, H., Wernsdorfer, W. H., Miller, R. S., & Wongsrichanalai, C. (2002). Histidine-rich protein II: A novel approach to malaria drug sensitivity testing. *Antimicrobial Agents and Chemotherapy, 46(6),* 1658-1664.

Nogueira, C. R., & Lopes, L. M. X. (2011). Antiplasmodial natural products. *Molecules, 16(3),* 2146-2190.

Noor Rain, A., Khozirah, S., Mohd Ridzuan, M. A. R., Ong, B. K., Rohaya, C., Rosilawati, M., Hamdino, I., Badrul A., & Zakiah, I. (2007). Antiplasmodial properties of some Malaysian medicinal plants. *Tropical Biomedicine, 24(1),* 29-35.

Nor, H. M. (1998). *Warga Pribumi Menghadapi Cabaran Pembangunan.* Bangi: Universiti Kebangsaan Malaysia.

Nyiligira, E., Viljoen, A. M., Van Heerden, F. R., Van Zyl, R. L., Van Vuuren, S. F., & Steenkamp, P. A. (2008). Phytochemistry and *in vitro* pharmacological

activities of South African *Vitex* (Verbenaceae) species. *Journal of Ethnopharmacology, 119(3),* 680-685.

O'Hara, M., Kiefer, D., Farrell, K., & Kemper, K. (1998). A review of 12 commonly used medicinal herbs. *Archives of Family Medicine, 7(6),* 523-536.

Olasehinde, G. I., Ojurongbe, O., Adeyeba, A. O., Fagade, O. E., Valecha, N., Ayanda, I. O., Ajayi, A. A., & Egwari, L. O. (2014). *In vitro* studies on the sensitivity pattern of *Plasmodium falciparum* to anti-malarial drugs and local herbal extracts. *Malaria Journal, 13(1),* 63-69.

Oliveira, A. B., Dolabela, M. F., Braga, F. C., Jácome, R. L. R. P., Varotti, F. P., & Póvoa, M. M. (2009). Plant-derived antimalarial agents: New leads and efficient phythomedicines. Part I. Alkaloids. *Anais da Academia Brasileira de Ciencias, 81(4),* 715-740.

Olorunnisola, O. S., Adetutu, A., Balogun, E. A., & Afolayan, A. J. (2013). Ethnobotanical survey of medicinal plants used in the treatment of malarial in Ogbomoso, Southwest Nigeria. *Journal of Ethnopharmacology, 150(1),* 71-78.

Oluwole, F. S., Ayo, J. A., Omolaso, B. O., Emikpe, B. O., & Adesanwo, J. K. (2008). Methanolic extract of *Tetracera potatoria*, an antiulcer agent increases gastric mucus secretion and endogenous antioxidants. *Nigerian Journal of Physiological Sciences*, *23*(1-2), 79-83.

Omar, A. H. (1983). *The Malay peoples of Malaysia and their languages*. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Omar, M. Z., Asnam, N. A., Zulkifli, H. B., Hamid, A. N. A., Abu Samah, Z., Talha, A. H., Haron, H. N., Huda, N., Salleh, H. M., & Mabot, A. (2008). *Khazanah Endau Rompin Herba*. 2nd ed. Johor: Perbadanan Bioteknologi dan Biodiversiti Negeri Johor.

Omar, M. Z., Ghazali, N. H. M., Asnam, N. A., Hamid, A. N. A., Abu Samah, Z., Talha, A. H., Haron, H. N., Nurul Huda, & Salleh, H. M. (2007). *Khazanah Endau Rompin Herba*. 1st ed. Kuala Lumpur: Utusan Publications & Distributors Sdn Bhd.

Ong, H. C., & Nordiana, M. (1999). Malay ethno-medico botany in Machang, Kelantan, Malaysia. *Fitoterapia*, *70(5)*, 502-513.

Ong, H. C., & Norzalina, J. (1999). Malay herbal medicine in Gemencheh, Negri Sembilan, Malaysia. *Fitoterapia, 70(1),* 10-14.

Ong, H. C., Ahmad, N., & Milow, P. (2011). Traditional medicinal plants used by the Temuan villagers in Kampung Tering, Negeri Sembilan, Malaysia. *Ethno Medicine, 5(3),* 169-73.

Ong, H. C., Chua, S., & Milow, P. (2011). Ethno-medicinal plants used by the Temuan villagers in Kampung Jeram Kedah, Negeri Sembilan, Malaysia. *Ethno Medicine, 5(2),* 95-100.

Ong, H. C., Faezah, A. W., & Milow, P. (2012). Medicinal plants used by the Jah Hut Orang Asli at Kampung Pos Penderas, Pahang, Malaysia. *Ethno Medicine, 6(1),* 11-15.

Ong, H. C., Lina, E., & Milow, P. (2012). Traditional knowledge and usage of medicinal plants among the Semai Orang Asli at Kampung Batu 16, Tapah, Perak, Malaysia. *Ethno Medicine, 6(3),* 207-211.

Osman, C. P., Ismail, N. H., Ahmad, R., Ahmat, N., Awang, K., & Jaafar, F. M. (2010). Anthraquinones with antiplasmodial activity from the roots of *Rennellia elliptica* Korth. (Rubiaceae). *Molecules, 15(10),* 7218-7226.

Padayachee, T., & Odhav, B. (2001). Anti-amoebic activity of plant compounds from *Virgilia oroboides* and *Chlorophora excelsa*. *Journal of Ethnopharmacology, 78(1),* 59-66.

Paniker, C. K. J. (2007). *Textbook of Medical Parasitology*. 6th ed. New Delhi: Jaypee.

Panyaphu, K., Van On, T., Sirisa-ard, P., Srisa-nga, P., ChansaKaow, S., & Nathakarnkitkul, S. (2011). Medicinal plants of the Mien (Yao) in Northern Thailand and their potential value in the primary healthcare of postpartum women. *Journal of Ethnopharmacology, 135(2),* 226-237.

Patel, D. K., Patel, K., Duraiswamy, B., & Dhanabal, S. P. (2012). Phytochemical analysis and standardization of *Strychnos nux-vomica* extract through HPTLC techniques. *Asian Pacific Journal of Tropical Disease, 2,* S56-S60.

Perme, N., Choudhury, S. N., Choudhury, R., Natung, T., & De, B. (2015). Medicinal plants in traditional use at Arunachal Pradesh, India. *International Journal of Phytopharmacy, 5(5),* 086-098.

Philippe, G., Angenot, L., De Mol, P., Goffin, E., Hayette, M. P., Tits, M., & Frédérich, M. (2005). *In vitro* screening of some *Strychnos* species for antiplasmodial activity. *Journal of Ethnopharmacology, 97(3),* 535-539.

Philippe, G., Angenot, L., Tits, M., & Frédérich, M. (2004). About the toxicity of some *Strychnos* species and their alkaloids. *Toxicon, 44(4),* 405-416.

Pierre, S., Toua, V., Tchobsala, Fernand-N, T. F., Alexandre-Michel, N. N., & Jean, M. (2011). Medicinal plants used in traditional treatment of malaria in Cameroon. *Journal of Ecology and the Natural Environment, 3(3),* 104-117.

Plants Rescue. (2016). *Tacca integrifolia*. Retrieved February 8, 2016, from http://www.plantsrescue.com/tag/tacca-cristata/

Puff, C., & Chamchumroon, V. (2003). Non-indigenous Rubiaceae grown in Thailand. *Thai Forest Bulletin, 31,* 75-94.

Rahmatullah, M., Hossan, M. S., Hanif, A., Roy, P., Jahan, R., Khan, M., Chowdhury, M. H., & Rahman, T. (2009). Ethnomedicinal applications of plants by the traditional healers of the Marma Tribe of Naikhongchhari, Bandarban District, Bangladesh. *Advances in Natural and Applied Sciences, 3(3),* 392-401.

Rahmatullah, M., Hossan, S., Khatun, A., Seraj, S., & Jahan, R. (2012). Medicinal plants used by various tribes of Bangladesh for treatment of malaria. *Malaria Research and treatment, 2012,* 1-5.

Rasoanaivo, P., Ramanitrahasimbola, D., Rafatro, H., Rakotondramanana, D., Robijaona, B., Rakotozafy, A., Ratsimamanga-Urverg, S., Labaied, M., Grellier, P., Allorge, L., Mambu, L., & Frappier, F. (2004). Screening extracts of Madagascan plants in search of antiplasmodial compounds. *Phytotherapy Research, 18(9),* 742-747.

Rasoanaivo, P., Wright, C. W., Willcox, M. L., & Gilbert, B. (2011). Whole plant extracts versus single compounds for the treatment of malaria: Synergy and positive interactions. *Malaria Journal, 10(Suppl 1),* 1-12.

Razak, M. R. M. A., Afzan, A., Ali, R., Jalaluddin, N. F. A., Wasiman, M. I., Zahari, S. H. S., Abdullah, N. R., & Ismail, Z. (2014). Effect of selected local medicinal plants on the asexual blood stage of chloroquine resistant *Plasmodium falciparum*. *BMC Complementary and Alternative Medicine, 14(1),* 1-13.

Reddy, B. S., Sujith, T., Kumar, M. S., Babu, A. N., Rao, N. R., & Manjunathan, J. (2012). Malarial drugs got resistance. *International Journal of Pharmaceutical and Biomedical Research, 3(4),* 213-215.

Ríos, J. L. (2011). Ethnomedicinal Plants: Progress and the Future of Drug Development. in Rai, M., Acharya, D., Ríos, J. L. (Eds.). *Ethnomedicinal Plants Revitalization of Traditional Knowledge of Herbs*. Etats-Unis: Science Publishers, 1-24.

Rizwana, J. N., Nazlina, I., Razehar, A. R. M., Noraziah, A. Z. S., Ling, C. Y., Muzaimah, S. A. S., Farina, A. H., Yaacob, W. A., Ahmad, I. B., & Din, L. B. (2010). A survey on phytochemical and bioactivity of plant extracts from Malaysian forest reserves. *Journal of Medicinal Plants Research, 4(3),* 203-210.

Rohani, A., Aziz, I., Zurainee, M. N., Rohana, S. H., Zamree, I., & Lee, H. L. (2014). Current insecticide susceptibility status of Malaysian *Anopheles maculatus* Theobald to malathion, permethrin, DDT and deltamethrin. *Tropical Biomedicine, 31(1),* 159-165.

Sabran, S. F., Mohamed, M., & Abu Bakar, M. F. (2016). Ethnomedical knowledge of plants used for the treatment of tuberculosis in Johor, Malaysia. *Evidence-Based Complementary and Alternative Medicine, 2016,* 1-12.

Saifi, M. A., Beg, T., Harrath, A. H., Altayalan, F. S. H., & Al Quraishy, S. (2013). Antimalarial drugs: Mode of action and status of resistance. *African Journal of Pharmacy and Pharmacology, 7(5),* 148-156.

Salleh, K. M., & Latiff, A. (2002). *Tumbuhan Ubatan Malaysia*. Bangi: Universiti Kebangsaan Malaysia.

Sam, S. A. M., Seow, T. W., & Mohamed, M. (2013). Budaya hidup Orang Asli Jakun di Kampung Peta. *Prosiding Persidangan Penyelidikan dan Inovasi Kali ke-2*. Pulau Pinang. 265-273.

Samaha, A. N., & Robinson, T. E. (2005). Why does the rapid delivery of drugs to the brain promote addiction? *Trends in Pharmacological Sciences, 26(2),* 82-87.

Samuel, A. J. S. J., Kalusalingam, A., Chellappan, D. K., Gopinath, R., Radhamani, S., Husain, H. A., Muruganadham, V., & Promwichit, P. (2010). Ethnomedical survey of plants used by the Orang Asli in Kampung Bawong, Perak, West Malaysia. *Journal of Ethnobiology and Ethnomedicine, 6(5),* 1-6.

Sanders, K. C., Rundi, C., Jelip, J., Rashman, Y., Gueye, C. S., & Gosling, R. D. (2014). Eliminating malaria in Malaysia: The role of partnerships between the public and commercial sectors in Sabah. *Malaria Journal, 13(1),* 1-12.

Seow, T. W., Mohamed, M., Jamiran, M. N. S., Abidin, Z. Z. Z., Sam, S. A. M., & Sanmargaraja, S. (2013). Kajian awalan terhadap persekitaran masyarakat Orang Asli Jakun di Kampung Peta. *Prosiding Seminar Serantau ke-2 Pengurusan Persekitaran di Alam Melayu*. Riau. 327-336.

Sha'a, K. K., Oguche, S., Watila, I. M., & Ikpa, T. F. (2011). *In vitro* antimalarial activity of the extracts of *Vernonia amygdalina* commonly used in traditional medicine in Nigeria. *Science World Journal, 6(2),* 5-9.

Shankar, R., & Devalla, R. B. (2012). Conservation of folk healing practices and commercial medicinal plants with special reference to Nagaland. *International Journal of Biodiversity and Conservation, 4(3),* 155-163.

Singh, B., & Daneshvar, C. (2010). *Plasmodium knowlesi* malaria in Malaysia. *Medical Journal of Malaysia, 65(3),* 224-230.

Singh, D. N., Verma, N., Raghuwanshi, S., Shukla, P. K., & Kulshreshtha, D. K. (2006). Antifungal anthraquinones from *Saprosma fragrans*. *Bioorganic & Medicinal Chemistry Letters, 16(17),* 4512-4514.

Spangenberg, B., Poole, C. F., & Weins, C. (2011). *Quantitative Thin-Layer Chromatography: A Practical Survey*. London: Springer.

Srivastava, A., Patel, S. P., Mishra, R. K., Vashistha, R. K., Singh, A., & Puskar, A. K. (2012). Ethnomedicinal importance of the plants of Amarkantak region, Madhya Pradesh, India. *International Journal of Medicinal Aroma Plants, 2(1),* 53-59.

Srivastava, R. C., Singh, R. K., & Mukherjee, T. K. (2010). Indigenous biodiversity of *Apatani* plateau: Learning on biocultural knowledge of *Apatani* tribe of Arunachal Pradesh for sustainable livelihoods. *Indian Journal of Traditional Knowledge, 9(3),* 432-442.

Sriwilaijaroen, N., Kondo, S., Nanthasri, P., Auparakkitanon, S., Suzuki, Y., & Wilairat, P. (2010). Antiplasmodial effects of *Brucea javanica* (L.) Merr. and *Eurycoma longifolia* Jack extracts and their combination with chloroquine and quinine on *Plasmodium falciparum* in culture. *Tropical Medicine and Health, 38(2),* 61-68.

Stangeland, T., Alele, P. E., Katuura, E., & Lye, K. A. (2011). Plants used to treat malaria in Nyakayojo sub-county, western Uganda. *Journal of Ethnopharmacology, 137(1),* 154-166.

Subeki, S. (2008). Potency of the Indonesian medicinal plants as antimalarial drugs. *Jurnal Teknologi dan Industri Hasil Pertanian, 13(1),* 25-30.

Suratman. (2008). The Indonesian species of *Rennellia* Korth. (Rubiaceae). *Biodiversitas, 9(4),* 259-263.

Tabuti, J. R. (2008). Herbal medicines used in the treatment of malaria in Budiope county, Uganda. *Journal of Ethnopharmacology, 116(1),* 33-42.

Taylor, C. E., & Wong, K. M. (1987). Some aspects of herbal medicine among the Orang Hulu community of Kampung Peta, Johore, Malaysia. *Malayan Nature Journal, 41,* 317-328.

Tona, L., Cimanga, R. K., Mesia, K., Musuamba, C. T., De Bruyne, T., Apers, S., Hernans, N., Van Miert, S., Pieters, L., Totté, J., & Vlietinck, A. J. (2004). *In vitro* antiplasmodial activity of extracts and fractions from seven medicinal plants used in the Democratic Republic of Congo. *Journal of Ethnopharmacology, 93(1),* 27-32.

Traoré, M. S., Baldé, M. A., Camara, A., Baldé, E. S., Diané, S., Diallo, M. S. T., Keita, A., Cos, P., Maes, L., Pieters, L., & Baldé, A. M. (2015). The malaria co-infection challenge: An investigation into the antimicrobial activity of selected Guinean medicinal plants. *Journal of Ethnopharmacology, 174,* 576-581.

Traoré, M. S., Baldé, M. A., Diallo, M. S. T., Baldé, E. S., Diané, S., Camara, A., Diallo, A., Balde, A., Keita, A., Keita, S. M., Oularé, K., Magassouba, F. B., Diakité, I., Diallo, A., Pieters, L., & Baldé, A. M. (2013). Ethnobotanical survey on medicinal plants used by Guinean traditional healers in the treatment of malaria. *Journal of Ethnopharmacology, 150(3),* 1145-1153.

Tsabang, N., Fokou, P. V. T., Tchokouaha, L. R. Y., Noguem, B., Bakarnga-Via, I., Nguepi, M. S. D., Nkongmeneck, B. A., & Boyom, F. F. (2012). Ethnopharmacological survey of Annonaceae medicinal plants used to treat malaria in four areas of Cameroon. *Journal of Ethnopharmacology, 139(1),* 171-180.

Umar, A., Ahmed, Q. U., Muhammad, B. Y., Dogarai, B. B. S., & Mat Soad, S. Z. (2010). Anti-hyperglycemic activity of the leaves of *Tetracera scandens*

Linn. Merr. (Dilleniaceae) in alloxan induced diabetic rats. *Journal of Ethnopharmacology, 131(1),* 140-145.

United Nations Convention to Combat Desertification. (2014). Traditional Knowledge. Retrieved March 20, 2014, from http://www.unccd.int/cop/officialdocs/cop7/pdf/cst5eng.pdf

Virtual Medical Centre. (2012). Medicine or Drug Overdose. Retrieved December 21, 2015, from http://www.myvmc.com/lifestyles/medicine-or-drug-overdose/

Vythilingam, I. (2012). *Plasmodium knowlesi* and *Wuchereria bancrofti*: Their vectors and challenges for the future. in Bueno-Marí, R., & Jiménez-Pedró, R. (Eds.). *Global Change and Human Vulnerability to Vector-borne Diseases*. Lausanne: Frontiers. 54-62.

Wahyuni, T. S., Ekasari, W., Widyawaruyanti, A., Hirasawa, Y., Morita, H., & Zaini, N. C. (2009). Artopeden A, a new antiplasmodial isoprenylated flavone from *Artocarpus champeden*. *Heterocycles, 79(1),* 1121-1126.

Wangchuk, P., Bremner, J. B., Samten, Rattanajak, R., & Kamchonwongpaisan, S. (2010). Antiplasmodial agents from the Bhutanese medicinal plant *Corydalis calliantha*. *Phytotherapy Research, 24(4),* 481-485.

Wangchuk, P., Keller, P. A., Pyne, S. G., Taweechotipatr, M., Tonsomboon, A., Rattanajak, R., & Kamchonwongpaisan, S. (2011). Evaluation of an ethnopharmacologically selected Bhutanese medicinal plants for their major classes of phytochemicals and biological activities. *Journal of Ethnopharmacology, 137(1),* 730-742.

Weiss, C. R., Moideen, S. V. K., Croft, S. L., & Houghton, P. J. (2000). Activity of extracts and isolated naphthoquinones from *Kigelia pinnata* against *Plasmodium falciparum*. *Journal of Natural Products, 63(9),* 1306-1309.

White, N. J. (2008). Qinghaosu (Artemisinin): The price of success. *Science, 320(5874),* 330-334.

White, N. J., Pukrittayakamee, S., Hien, T. T., Faiz, M. A., Mokuolu, O. A., & Dondorp, A. M. (2014). Malaria. *The Lancet, 383(9918),* 723-735.

Wiart, C., Mogana, S., Khalifah, S., Mahan, M., Ismail, S., Buckle, M., Narayana, A. K., & Sulaiman, M. (2004). Antimicrobial screening of plants used for traditional medicine in the state of Perak, Peninsular Malaysia. *Fitoterapia, 75(1),* 68-73.

Wiesman, Z., & Chapagain, B. P. (2009). *Balanites Aegyptiaca* Saponins: Chemistry and Applications. in Brahmachari, G. (Ed.). *Natural Products: Chemistry, Biochemistry and Pharmacology*. United Kingdom: Alpha Science International Limited. 194-219

Wondimu, T., Asfaw, Z., & Kelbessa, E. (2007). Ethnobotanical study of medicinal plants around 'Dheeraa' town, Arsi Zone, Ethiopia. *Journal of Ethnopharmacology, 112(1),* 152-161.

Wong, K. M., Saw, L. G., & Kochummen, K. M. (1987). Some new and interesting plant species from Ulu Endau, Johore, Malaysia. *Malayan Nature Journal, 41,* 267-273.

Woodson, R. E., Schery, R. W., & Dwyer, J. D. (1980). Flora of Panama. Part IX. Family 179. Rubiaceae--Part 1. *Annals of the Missouri Botanical Garden, 67(1),* 1-256.

World Health Organization. (2006). *Guidelines for the Treatment of Malaria*. 1st ed. Switzerland: World Health Organization.

World Health Organization. (2013). Traditional medicine. Retrieved December 16, 2013 from http://www.who.int/topics/traditional_medicine/en/

World Health Organization. (2014). Malaria. Retrieved March 21, 2014, from http://www.who.int/mediacentre/factsheets/fs094/en/

World Health Organization. (2015a). Fact Sheet: World Malaria Report 2015. Retrieved February 22, 2016, from http://www.who.int/malaria/media/world-malaria-report-2015/en/

World Health Organization. (2015b). *Guidelines for the Treatment of Malaria*. 3rd ed. Switzerland: World Health Organization.

World Health Organization. (2016). Malaria. Retrieved May 29, 2016, from http://www.who.int/mediacentre/factsheets/fs094/en/

World Wildlife Fund. (2015). Forests. Retrieved January 20, 2015, from http://www.wwf.org.my/about_wwf/what_we_do/forests_main/

Yenesew, A., Induli, M., Derese, S., Midiwo, J. O., Heydenreich, M., Peter, M. G., Akala, H., Wangui, J., Liyala, P., & Waters, N. C. (2004). Anti-plasmodial flavonoids from the stem bark of *Erythrina abyssinica*. *Phytochemistry, 65(22),* 3029-3032.

Yenjai, C., Prasanphen, K., Daodee, S., Wongpanich, V., & Kittakoop, P. (2004). Bioactive flavonoids from *Kaempferia parviflora*. *Fitoterapia, 75(1),* 89-92.

Yetein, M. H., Houessou, L. G., Lougbégnon, T. O., Teka, O., & Tente, B. (2013). Ethnobotanical study of medicinal plants used for the treatment of malaria in plateau of Allada, Benin (West Africa). *Journal of Ethnopharmacology, 146(1),* 154-163.

Yokosuka, A., Mimaki, Y., Sakagami, H., & Sashida, Y. (2002). New diarylheptanoids and diarylheptanoid glucosides from the rhizomes of *Tacca chantrieri* and their cytotoxic activity. *Journal of Natural Products, 65(3),* 283-289.

Yusoff, M. M., Ahmad, F. B., & Pasok, G. (2003). Traditional medicinal plants of the Dusun Tobilung of Kampong Toburon. *Kudat, Sabah, Malaysia BRB, 34,* 120-128.

Zainon, A. S. (2004). Tumbuhan penawar pelbagai penyakit: Tongkat Ali, Kacip Fatimah dan Pegaga. *Proceedings of the Seminar on Medicinal Plants*. Kepong: Forest Research Institute Malaysia.

Zheng, X. L., Wei, J. H., Sun, W., Li, R. T., Liu, S. B., & Dai, H. F. (2013). Ethnobotanical study on medicinal plants around Limu Mountains of Hainan Island, China. *Journal of Ethnopharmacology, 148(3),* 964-974.

Zirihi, G. N., Mambu, L., Guédé-Guina, F., Bodo, B., & Grellier, P. (2005). In vitro antiplasmodial activity and cytotoxicity of 33 West African plants used for treatment of malaria. *Journal of Ethnopharmacology, 98(3),* 281-285.

Zwenger, S., & Basu, C. (2008). Plant terpenoids: Applications and future potentials. *Biotechnology and Molecular Biology Reviews, 3(1),* 1-7.